Comment on " Dynamics of a Potential Barrier Formed on the Tail of a Moving Double Layer in a Collisionless Plasma"

In their conclusion, Iizuka *et al.*[1] conjecture that "in a single-ended Q machine with a positively biased target the self-consistent potential distribution[2] seems to be hardly obtainable as it is unstable." The purpose of the present Comment is to point out that, in contrast to this conjecture, there is now both theoretical[3] and experimental[4] evidence according to which these distributions can, in fact, be obtained experimentally by raising the cold-plate (or grid) bias to sufficiently high values.

In a recent experimental study, Popa *et al.*[4] have found that the instability in question can be made to disappear by raising the (positive) dc bias U_E applied to the "exciting" cold electrode E (target electrode) above a certain critical value which depends on the detailed experimental conditions. For U_E not too far above this critical value, the electron sheath in front of E occupies a significant portion of the interelectrode distance, but there still remains a short plasma column between the hot plate and the sheath edge. This type of observed configuration basically corresponds to the collisionless plane-diode equilibria calculated by Kuhn[2,5] and Ott[6] (and in several references cited therein), although there may be differences in the details due to the fact that the Q machine is not really an ideal plane diode. A convincing experimental verification of the other types of self-consistent diode equilibria was given previously by Ott.[6]

In order qualitatively to understand this observed stabilization by large positive biases from a theoretical point of view, we best refer to a paper by Kuznetsov and Énder[3] where the conditions were studied under which a positively biased one-emitter diode with a monotonically increasing equilibrium potential distribution[2,5,6] can become unstable to the so called "electronic transients," i.e., rapid overall rearrangements of the electron distribution for a given ion distribution. As exemplified by their[3] Fig. 3, the self-consistent equilibria are absolutely stable to all electronic transients if, for given interelectrode distance and neutralization parameter,[2,5,6] the bias is raised above some critical value. With decreasing bias, the system goes through regions where the self-consistent equilibria are alternatingly stable and unstable with respect to small perturbations of the electron distribution. However, those equilibria which are linearly stable are only conditionally stable, i.e., they are still unstable to finite-amplitude perturbations and obviously not realized under normal experimental conditions. For the linearly unstable cases it has been pointed out recently[7] that the mechanism for the onset of the electronic transients is basically that of the well-known Pierce instability.[8]

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